TACTfully Byting the Bard: A Computer-Assisted Text-Retrieval-Based Approach to *Henry V*

Catherine Broderick

要約

TACTfully Byting the Bard:
コンピューターによるテクスト検索を用いた『ヘンリー五世』へのアプローチ

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文学作品のコンコーダンスや索引に用いられていたコンピューター・プログラムは，過去20年以上にわたって，文学のコンピューターを用いた数学的・統計的な研究によって拡張されてきた。今日では，自然科学の訓練を受けた研究者ばかりでなく，なんとかコンピューターを使いこなせる程度の人文科学研究者も，使いやすくなったプログラムのおかげで，文学作品のコンピューターを用いた文体論的，テーマ論的な研究（Literary Computing）に取り組むことが可能になっている。こうしたソフトウェアのひとつに，トロント大学人文科学計算機センターのジョン・ブラッドレー（John Bradley）によって開発された，対話型テクスト検索プログラム（TACT：the interactive text-retrieval program）がある。本論文では次の三点を概観したい。TACT 以前のコンピューターを用いた文学研究。シェイクスピアの『ヘンリー五世』を例にして，どのように TACT が応用できるか。同様のプロジェクトが，コンピューターを用いた文学テクスト読解（精読および多読）に，いかなる可能性・発展性を有しているか。

Today computers are standard
tools for amateur and
professional literary
investigators alike.
Edward Dolnick

The assertion that computers
can be useful tools in
literary study is, of
course, no longer
controversial.
Rosanne G. Potter

Today, whether one consults the index of a book, a critical edition, or a concordance to the works of an author, one is more likely than not indebted to a computerized compilation. Not only linguistic but influence and authorship studies proliferate and become more convincing with the assistance of computer programs. In these latter, stylistic study reveals what we might call individual pen-prints, the style indicators found by increasingly sophisticated computer programs on increasingly fast computers, are those that a human with pencil and paper would take several lifetimes to discover.

A very recent example appeared in the popular press, the October 1991 issue of *Atlantic Monthly*, in which a lively exchange between the proponents of the Oxfordian and the Stratfordian theories of the identity of the author we call William Shakespeare was followed by a fascinating explanation by Edward Dolnick of authorial identification by computer analysis of a sonnet by an unknown author revealed to be "Shakespeare." Ronald Thisted, along with a statistics professor, Bradley Efron, calculated how many words Shakespeare knew but never used, then tested the anonymous sonnet, estimating it should have seven new words—and found nine. With other pen-prints matching, "the poem, which sounds nothing like Shakespeare, fit Shakespeare like a glove" (Dolnick 84). Authorial identification/attribution is a thriving computer industry.

Dissenters are legion, of course.[1] "Like many Shakespeareans, [Donald Foster of Vassar College] steers clear of the 'authorship question'" (Dolnck 86). By isolating what are called "rare" words (used ten times or fewer), and positing that such words cluster in the mind of a writer, Foster set himself the challenge of identification of the roles that Shakespeare played in his own plays. Figuring that while playing a role, the "rare words" in that role would stick in Shakespeare's mind while he was writing another play offstage, Foster matched staged with in-progress plays to claim, for instance, that Shakespeare played the Chorus role in *Henry V* (Dolnick 86).

Such easily readable renditions of computer analyses of Shakespeare indicate both the advances in computer technology and programming as well as the desktop-PC-driven democratization of such research in general. In contrast, a perusal of the 1973

issue of *Computer Studies in the Humanities and Verbal Behavior*, a special issue devoted to computer research and teaching of Shakespeare, in comparison with a February 1991 issue of *Computers in the Humanities* is revealing. In contrast to such an article for general readership as the one in *Atlantic Monthly*, the earlier studies are compendia of mathematical and statistical formulas, detailed computer programs and flow charts, and highly technical discussion (Fig. 1). The sea change seen today is that the minimally computer-literate humanities researcher now finds these arcane aspects of electronic analysis have been skillfully put into user-friendly applications. Mathematical and statistical operations are performed in the computer's innards, and rendered in graphic form to be manipulated by the researcher.

Figure 1

Play	d. f.	χ^2	Significance level of P
J. C.	7	16.0	.03
R. Ⅲ	7	15.8	.03
H. Ⅳ Pt. 2	7	10.8	.11
T. S.	7	16.3	.03

To see how this modified McCurdy hypothesis compares to the Zipf's Law hypothesis, we can try fit Zipf's Law to our data play by play.

$$(5)\ \sum_{i=1}^{n}(y_i-\bar{y})^2=\sum_{i=1}^{n}(y_i-\hat{y}_i)^2+r^2\sum_{i=1}^{n}(y_i-\bar{y})^2$$

where $y_i=\ln w_i$, the mean of the y_i is

$$\bar{y}=\frac{1}{n}\sum_{i=1}^{n}\ln w_i,$$

and the ordinates are predicted by the regression equations; in the case of equation (4)

$$\hat{y}_i=\ln a+b\ln i$$

and in the case of equation (2)

$$\hat{y}_i=\ln a+b\,i$$

In contrast to the "traditional" concordance, index and word frequency programs, such as Micro-OCP, used for the concordances and the stylistic identification work mentioned above, more recent ways to do many sorts of investigations electronically include interactive text-retrieval programs, sometimes called simply search programs. Search and count and *locate*, or set in KWIC (key-word-in-context): these are the basic functions of a computer-assisted text-retrieval analysis of a written text. Although the results are dazzling to the layperson, the technology is now elementary. The boon has been in the ever larger memory within newer computers and the ever faster calculations they can perform abetted by the programmers who create software for literary critics' use. In the past, programmer and interpreter were the same person—no longer. Ordinary literary researchers can use a variety of programs to enhance their studies. To break new ground, as has always been true in literary criticism, the imagination of the critic in the development of her hypothesis prior to use of her tools is the determinant of the ultimate usefulness of those tools.

With the late twentieth century trend to inclusion of "scientific" literary criticism as methodology, as in Russian Formalism and French structuralism, and to demonstration of the scientific "revolutions" of relativity, quantum physics and chaos theory in literature,[2] scholars still influenced by the close textual reading of the New Criticism have increasingly turned to computer-assisted literary analysis, or what Rosanne Potter calls "literary computing" (xv-xvi) for further experimentation and testing of their readings of

texts. Ever more precise identification of data, of repetitive patterns, of positioning of words and phrases in texts, among other possibilities, lead to creative insights into the critical project.

A 1988 review of Rudall and Corns *Computers and Literature: A Practical Guide* begins: "When computers perform literary criticism, they will be belle-lettriste, prestructuralist, post-structuralist, neo-Leavisite and Marxist" (Burnard 163). It may be more accurate to paraphrase Albert Cook's review of interpretive strategies for non-computer studies of Shakespeare, and say that when certain speech-act or reader-response theorists, Lacanians, Foucauldians, Marxists, deconstructionists, or any other of the proliferating hermeneutic strategists' "interpretive communities" (775 *et passim*) perform literary criticism on Shakespeare's plays, they will use computer-generated data to lead to critical decisions.

The critical decisions of computer-using researchers in the shadow of the 21st century are increasingly supplementing the concordance, authorial identification, pattern studies, distribution studies or linguistic studies with stylistic and thematic projects. Several methodological paths beckon: the most thorough may be the one necessitating a situating of the text being studied in the context of all the texts available to that writer at the time of the writing of the text under immediate consideration, and analyzing always in that context. "Thus, with a properly constituted Renaissance textual database, we could read Shakespeare's or Milton's texts with a reanimated awareness of at least the literary culture in which readers originally interpreted them. Without forgetting what we know we may acquire the memory of the Renaissance readership" (Corns 129). Or, a researcher may work with the corpus of a given writer. Lastly, in the spirit of the close reading, the study of a single text may be enhanced by data gleaned from a computer analysis. With the accessibility and user-friendliness of programs amenable to this latter, the computer-using research corps is growing to include strictly academic (i. e., non-technical, or as the joke goes, techno-peasant) professionals.

What can such a researcher do with a text-retrieval program? TACT can show five different textual situations:

KWIC: A Keyword-in-context concordance of the selected word (with a five-line context).

Text: The document itself, at the place of the first occurrence of the selected word.

Index: A one-line keyword-in-context concordance of the selected word.

Distribution: A graph of the number of occurrences in each 10% of the text listed vertically from 0 to 90-100%.

Collocate: A table of the collocates (or words co-occurring within five words on either side) of a selected word, listed vertically by descending z-score, a statistical measure of close association (Bradley 6).

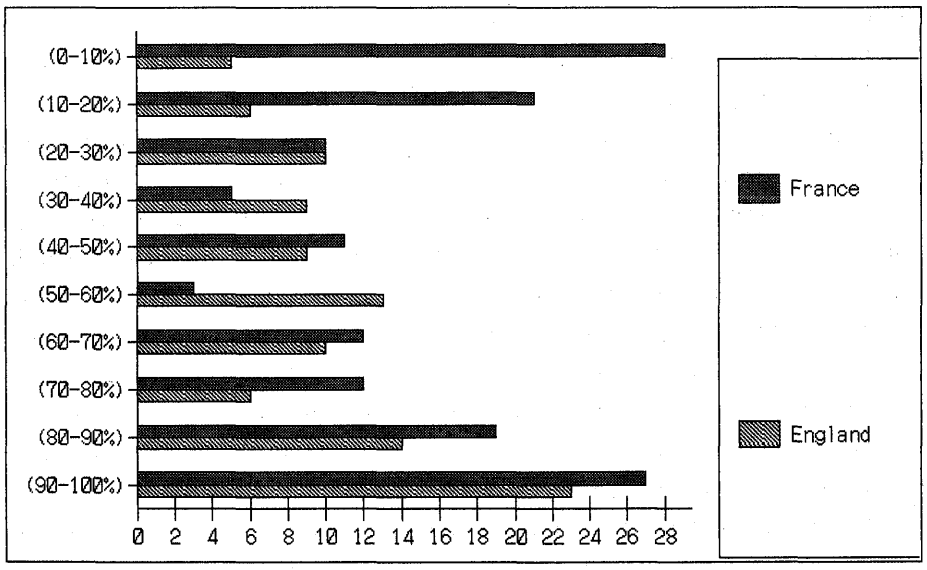
Bradley goes on to suggest that more refined searches can be made, for example, "What words ending in "ing" occur in this text?" "Find me only the places where Romeo speaks of love." "Find me the places in the text where the words "cold" and "death" occur in the same paragraph" (44). In addition, the researcher can specify her own rules, customizing

the program to her research project. Not only can single words be selected, but also phrases and co-occurrences. Without beginning to do justice to TACT's powerful appplications, not being a Shakespeare scholar, I can only treat here a few limited and rather playful possibilities.

Searching, for example, in the deconstructionist mode, for the gaps in a text, one may find in *Henry V* that word usage for "France/French" (146) and "England/English" (100) and their derivatives leads to a preponderance of French influence with a chasm at the

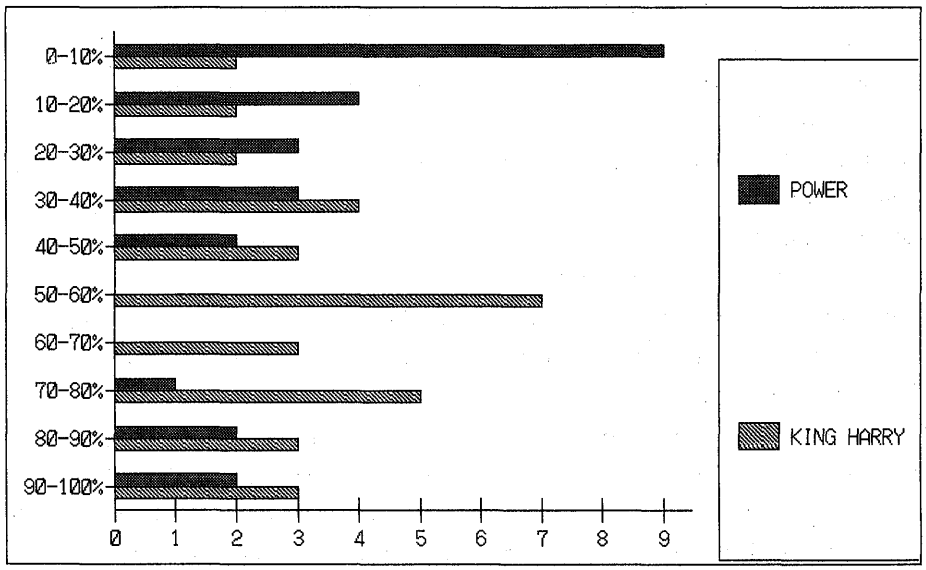
Figure 2

Occurrences of "France" and "England" and their derivatives



Occurrences of "power" and "might" and their derivatives
"puissant(ce)"

Occurrences of King Harry as speaker



linear center of the text which corresponds to the same gap for occurrences of "power(s)" (10) and "mighty/mightiness" (14) ("might" of course can also be a verb and so is momentarily excluded) (Fig. 2). Contrasting this with Brainerd's word-count revision of McCurdy's line-count study of how much each character in a Shakespeare play speaks to note King Harry's loquaciousness superior to the other 49 characters (also Fig. 2) both reinforces the graphic notion of a gap at the center of the text and sets up a thematic tension between political forces. In the former case, the gap at the center of the text—the statistically low number of references to important motifs at the linear half-way mark in the play—suggests a structural investigation of Shakespeare's theatrical tension-heightening and tension-lowering in relation to his indications of primary thematic importance. In the latter case, the question of the power points in the play—when and by whose actions power changes hands, both within a scene and in the historical arena—can be approached through a series of studies on the tensions between verbal treatment of enemies, victor and vanquished, and a questioning of the relative positions of political power-holders in a larger-than-the-theatrical moment historical context. The fact, for example, that King Harry is the greatest user of "power-related" words pulls against the fact of the preponderance of words related to his adversaries. Investigation in depth of this tension would be possible with a computer study.

Further, imagery suggesting power to the audiences of the time would need to be isolated with more sophisticated procedures than word counts, for it is obvious that vocabulary and imagery are not the same thing. Spurgeon's colossal work on *Shakespeare's Imagery* which highlights, for example, imagery of "swift and soaring movement" (243) bolstered by bird imagery—a project statistical in origin (viz. the five-colored graphs in the appendix) which begs to be re-done with computers—is a tantalizing suggestion of the linguistic work needed to locate the power points in the play using both vocabulary and imagery.

There are today numerous choices of computer programs with which to test these insights or awaken new ones. *WordCruncher*, from Electronic Text Corp., the Oxford Concordance Program *Micro-OCP*,[3] *Nota Bene / TBS* from Dragonfly (Bolton), Clan WDLEN Program from the Norwegian Computing Centre for the Humanities (Ervin)[4] or the "shareware [interactive] text-retrieval program TACT" from the University of Toronto (Bolton) are among task-specific literary analysis programs easily available to the researcher with a desktop PC and a passable computer literacy level.

All of these applications go beyond the simpler style-and-grammar checker programs that students and other writers use, such as *Grammatik* or *RightWriter*. For modern works, these checking programs often provide startling insights and comparisons among texts, but are more challenging to use in a Renaissance context. For the purposes of the present study, they have been set aside.

A strong disclaimer is in order here. In no way am I presuming to be a Shakespeare scholar. One who is conversant with the field would readily pull the Renaissance words indicating power from the word frequency list and place them both in the play and with their collocates with ease (Fig. 3).[5]

My experimental use of the shareware interactive text-retrieval program TACT, developed by John Bradley at the Centre for Computing in the Humanities (CCH) at the University of Toronto,[6] followed by attempts to discover ways in which it can be used in computer-assisted literary analysis, require machine-readable text(s) on which to work. Although the entire Library of America is on disk, promising possibilities of analyzing the classic texts of American literature, availability is a seriously limiting consideration.

Figure 3

Collocate (above 10) for the 100 occurrences of words with "power(s) / puissance(t)":

Collocates	Sel. Node	Collocate Freq	Type Freq	Z-score
alter		1	1	13.019
augment		1	1	13.019
captive		1	1	13.019
defeat		1	1	13.019
entreated		1	1	13.019
pike		1	1	13.019
pith		1	1	13.019
ratify		1	1	13.019
renew		1	1	13.019
returns		1	1	13.019
trail'st		1	1	13.019
unmasked		1	1	13.019
uttermost		1	1	13.019
arrived		1	2	9.152
bend		1	2	9.152
great-grandfather		1	2	9.152
imaginary		1	2	9.152
⋮				
france		3	91	3.396
⋮				
english		1	48	1.362

Collocates (above 10) for the 140 occurrences of words with "migthy / mightiness":

Collocates	Sel. Node	Collocate Freq	Type Freq	Z-score
annoy		1	1	15.977
buffet		1	1	15.977
finger		1	1	15.977
interview		1	1	15.977
mickle		1	1	15.977
spark		1	1	15.977
tartar		1	1	15.977
throngs		1	1	15.977
evil		1	2	11.253
fate		1	2	11.253
fury		1	2	11.253
prey		1	2	11.253
walk		1	2	11.253
⋮				
french		1	55	1.702

The same holds true for the huge number of machine-readable texts in the Oxford Text Archive, or other literary text archives such as the Gutenberg Project and the Center for Electronic Texts in the Humanities at Rutgers University—one must have the budget to purchase the disks containing the texts one wishes to analyze with a computer program or resort to scanning them oneself (given the availability of a scanner, which is an electronic version of a photocopy machine) or actually type them in by hand. Having typed a great deal of Thomas Hardy's *The Return of the Native* and George Meredith's *Diana of the Crossways* into machine-readable form for the purpose of electronically analyzing them, I was forced to face defeat—surely retirement age would overwhelm me before I could type enough novels to do a decent study.

Because my institution has only the works of Shakespeare in machine-readable form,[7] necessity directed me to a TACTful experimentation with *Henry V*—a pure exercise in use of the computer software, since the study of Shakespeare is far from my scholarly concerns and mastering enough of the scholarship to do a convincing study of any type falls into the category of typing enough nineteenth-century novels to do the same. Thus, the Shakespearean text in this case is used as suggestive tutorial for the literary computing project, and the questions raised for future projects remain unavoidably and regretfully without a research context.

Even in the Shakespearean project however, Thomas N. Corns' review of the efforts in academic literary computer-based literary criticism, noted above, is not to be overlooked. In the immediate context, his reminder that "since the later writings of Roland Barthes (1980), it has been a shibboleth of theoretically respectable criticism that the meaning of a text is produced by the relationship of that text to other texts, the concept known as intertextuality. . ." (129). Although extremely challenging, the necessity of "wrap[ping] around any text the intertext that *surrounded it at its genesis*, or at least a subset of that intertext" (129, emphasis mine) is not to be discarded lightly. This means that a single machine-readable text purchased, scanned or keyboarded will almost never suffice for fully integrated area studies.

Computer-based literary study will necessarily include large numbers of texts' being run through computer programs to test the validity of a single hypothesis. Indeed, the texts will not only have to be run, but re-run, for at present it is very difficult to use previously published research unless one duplicates exactly the conditions of text and software used in the published study. When Brainerd tells us that King Harry, the most loquacious character, speaks 8338 words in *Henry V*, the first question the subsequent researcher asks after "What text did he use?" is "what constitutes a word in Brainerd's count?" The question becomes vital when a word count made with different text and software makes King Harry far more verbose with an alleged 9129 words spoken. McCurdy recognized this sort of problem long before sophisticated computer programs appeared on the scene: in his 1953 study of the personality of Shakespeare using statistics such as line counts, he said, "More important, it must be admitted that defining exactly what a line is and sticking to it are operations far from easy. An interesting side light (sic) on the problem is found in G. Udny Yule's *The Statistical Study of Literary*

Vocabulary, where the distinguished author is hard put to define for purposes of counting what constitutes a word" (49). Often derided as hi-tech hocus-pocus, computer-assisted literary criticism is actually a return to the meticulous schorlarship of bygone years.

On the other hand, the suggestiveness of a single-text computer analysis is resonant with thematic studies. Testing the critical hypothesis by means of exhaustive hard data is fast becoming a basic requirement. Wishing to test a few hypotheses in a single Shakespearean play, then, how does a novice user apply TACT's text-retrieval capabilities to a textual analysis? Before even calling up the TACT program (which uses an excerpt from *Volpone* as tutorial), it is necessary to reformat the machine-readable text from the Oxford archives into TACT-readable from. Each computer program used in literary analysis has a distinct markup system which enables it to create a textual database, or list of words in the text. "Classic" methods of indicating diacritics, non-standard Roman alphabet letters, chapter numbers, stage directions, and other textual components which would not be entered into a database for analysis must be indicated by a markup system consistent with the computer program. The two classic markup systems are COCOA and BYU markers, but each applications program has its own conventions. Thus, if a machine-readable text has been prepared for a specific computer program and is then used with another, the marking of the text must be revised carefully. This was the case with the preparation of the text of *Henry V* for analysis by

Figure 4

Oxford Markup :

```
0   〈0 22〉 〈H H5〉 〈D 1598-9〉 〈K play〉 〈A Shakespeare〉
0   〈T title〉 The Life of Henry the Fifth
0   〈Y Pr〉 〈T dsd〉 {Enter Chorus as Prologue}
1   〈S CHORUS〉 〈T verse〉 0 for a muse of fire, that would ascend
2   The brightest heaven of invention :

20A 〈S ELY〉 This would drink deep.
21A 〈S CANTERBURY〉 'Twould drink the cup and all.
22A 〈S ELY〉 But what prevention ?
23  〈S CANTERBURY〉 The King is full of grace and fair regard.
24  〈S ELY〉 And a true lover of the holy Church.
25  〈S CANTERBURY〉 The courses of his youth promised it not.
26  The breath no sooner left his father's body
```

TACT markup :

```
〈p The Life of Henry the Fifth〉
〈a 1〉 〈sc 0〉
((Enter Chorus as Prologue))
(*CHORUS*) 0 for a muse of fire, that would ascend
The brightest heaven of invention :

(*ELY*) This would drink deep.
(*CANTERBURY*) 'Twould drink the cup and all.
(*ELY*) But what prevention ?
(*CANTERBURY*) The King is full of grace and fair regard.
(*ELY*) And a true lover of the holy Church.
(*CANTERBURY*) The courses of his youth promised it not.
The breath no soooner left his father's body
```

TACT—markup had to be redone by hand, changing, for example, the indication of a character's speaking as "S" to "*"(Fig. 4).

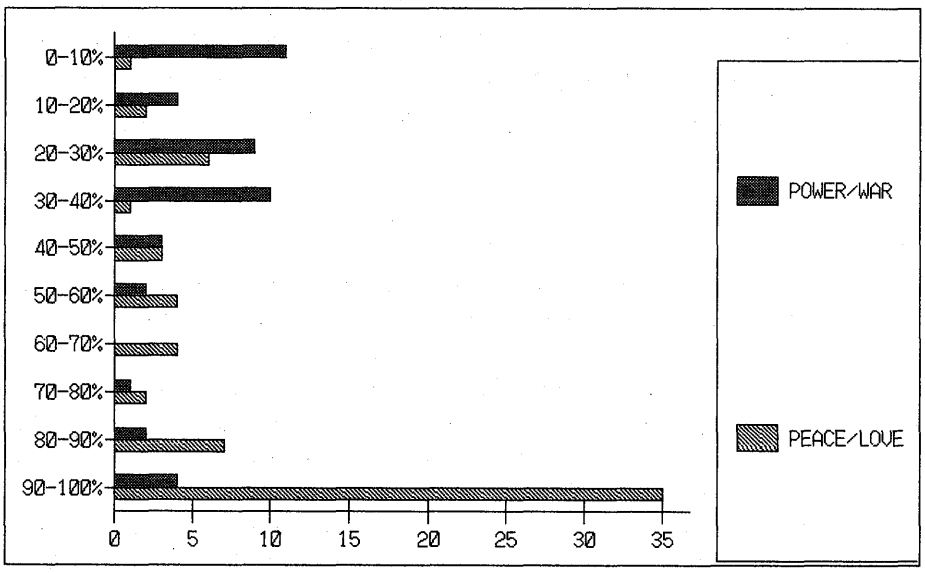
After the laborious work of changing the markup line-by-line throughout the play, next comes the creation of the database—done, of course by the computer program which will catch any misakes or oversights one has made in the markup revision; these errors necessitate starting the process all over, changing the mistaken markup and re-making the database TACT will use to perform its analysis. Once the preliminary work of creating a database for the entire play of *Henry V* has been completed, TACT is ready to retrieve, analyze and compute occurrences in the text.

To return to the very simple rendering we saw above in Fig. 2, TACT tells us quickly that halfway through the play, in the middle 20% of the text, England takes a momentary linguistic (occurrences of "France" and "England") lead over France, that "power" and "might" and "blood" words disappear with France from the text, and that with "England's" ascendancy Harry here speaks the most times of any other tenth portion of the text. The play appears "top-heavy"—power, might, war are loaded into the top 40% of the text (and King Harry mentions them the most often of any character), giving way after the center to peace and love (also most often spoken by King Harry). Here is the distribution throughout the play (Fig. 5). This graph corresponds to the ironic wilting of

Figure 5

Occurrences of "power/might," "war" and their derivatives

Occurrences of "peace" and "love" and their derivatives



virile (meaning not only self-image but sheer numbers of troops) French power at the linear center also—and the foreshadowing of Catherine's being given to the victorious English King in marriage in the lines:

Where have they [the English] this mettle? Ⅲ. 5. 15

Our madams mock at us, and plainly say
Our [French] mettle is bred out, and they will give
Their bodies to the lust of English youth,
To new-store France with bastard warriors. Ⅲ. 5. 28-31

In a study like Karen Newman's on the sexual exchange obvious here in the foreshadowing of the formation of the Harry-Catherine dyad, but threaded throughout the power exchange between victorious England and vanquished France, the Renaissance and previous tradition of the language of such exchange could be exhaustively pursued with computer applications. Structural studies of the play's "physical arrangement" could be joined with the linguistic consideration of words and phrases, their locations and collocates, both historical and in the text under study, to graphically display the Bard's thematic web.

Pedagogically, too, the computer can come to the aid of the professor. Nearly twenty years ago a detailed program of projects to teach Shakespeare with the computer was listed by Fred R. MacFadden, Jr.[8] These included "dispersion patterns of curses and oaths in the Shakespeare canon," or "a comparison of major and minor sentence types in Shakespeare and Goethe" (5). Today, with the program TACT, "interactive" is not only a property of the program, but of the use of the program in a classroom: "a teacher can prepare a script to walk through a TACT session, illustrating particular things about the text, and the student can view the demonstration by running the script file" (Bradley 82).

One day students will be able go beyond even this real-time process to live the play in virtual reality, lending a new and thrilling dimension to theater studies. In sum, accessibility and understandability of computer applications in literature render "computer method and both literary and pedagogic theory seem[ingly] reconcilable" (Corns 130), and to increasing numbers of scholars working with them, both exciting and revealing[9].

Notes

1. In addition to the dissenters within an academic argument, Thomas N. Corns provides us with an amusing round-up of the dissenters to the computer applications of the literature project itself: "traditionalists still observe us with suspicion—we murder to dissect. Post-structuralists regard us as engaged in an inherently foolish enterprise, mistaking the modality of the text, absurdly unaware of the inadequacy of our categories; feminists regard us as involved in the fetishizing of the machine, the toys for the boys critique; marxists disclose the political implications of the seemingly apolitical nature of our analysis" (129).
2. N. Katherine Hayles has contributed important and accessible work in the area of intersection of science and literature in the modern age. Her books, *The Cosmic Web: Scientific Field Models & Literary Strategies in the 20th Century*, Ithaca: Cornell UP, 1984; *Chaos Bound: Orderly Disorder in Contemporary Literature and Science*, Ithaca: Cornell UP, 1990; and, as editor, *Chaos and Disorder: Complex Dynamics in Literature and Science*, Chicago: U of Chicago P, 1991, are concerned with the ways in which literature, science, technology and culture have related deeply with each other in the twentieth century. In the first, after reviewing field model

theories and implications, Hayles studies Pirsig, Lawrence, Nabokov, Borges and Pynchon. In the second, she explains "the development of information technologies after World War II leading to a "feedback cycle [which] connected theory with culture and culture with theory through the medium of technology. Literary texts and theories were also involved in this cycle, for they too were affected by technology, at the same time that they were affecting it. It should be no surprise, then, that many of the presuppositions that underlie the literary texts are also embedded within the scientific models and theories of the period." Hayles goes on to apply these theories to *The Education of Henry Adams* and *The Golden Notebook*. The third, a collection of essays, is in three parts: the first asks "what are we to make of implicit convergences between the science of chaos and postmodern critical theory and literature?"; second, a selection of essays which return to the past and re-read older texts; and third, "essays which explore critical and literary works in which there is a tension between chaotics, with its new vision of disorder, and a sedimented history that constructs order in traditional ways."

3. For an exhaustive review of Micro-OCP see Jones. He tells us that in "1957 the Reverend John W. Ellison gave the world its first computer-generated concordance, to the Revised Standard Version of the Bible." He kindly notes, with great understanding of those of us laboring in the vineyards, that the 400 hours of work by the computer itself do not indicate in any way "how much time was spent in entering and proof reading (sic) the text or writing the computer program." Micro-OCP "makes indexes, concordances and word lists from texts in a variety of languages. It is not an interactive text-retrieval program" like TACT is. In line with the argument of this paper that computer analysis of literary texts is a techno-democratized skill, he notes that Micro-OCP "requires no programming experience or technical understanding of the computer." TACT does not require such experience or understanding either, although it produces more complex data about a text.
4. P. Timothy Ervin, who uses the Clan WDLEN Program from the Norwegian Computing Centre for the Humanities, has been extremely helpful in providing information and encouragement for this project. I wish to acknowledge his help with thanks.
5. The collocate display is "the most complex display TACT can produce. It shows all the words that occur near [within 5 words each side] to the selected words in the text. The word types are organized by their Z-scores—a standard statistical measure of significance of their co-occurrence in a statistical sense" (Bradley 12). See also, in Hays: "A major use of the mean and standard deviation is in transforming a raw score into a **standardized score** [a z-score], showing the *relative status* of that score in a distribution. If you are given the information, "John Doe has a score of 60," you really know very little about what this score means. Is this score high, low, middling, or what? However, if you know something about the distribution of scores for the group including John Doe, you can judge the location of the score in the distribution. The score of 60 gives quite a different picture when the mean is 30 and the standard deviation is 10 than when the mean is 65 and the standard deviation is 20" (180).
6. Although WordCruncher was recently put on sale by the MLA at US$125, its list price of US $295 did not heretofore put it within reach of the average academic. TACT, at US$29 is both affordable and powerful. In addition, the researchers at the University of Toronto respond directly to users via e-mail, a situation more difficult to achieve when using commercial applications. For this study, TACT was used on a Toshiba Dynabook J-3100 with a 20MB hard disk.
7. The text was prepared for use with *The Oxford Concordance Program* in 1988 from the 1986 Oxford University Press edition of *William Shakespeare: The Complete Works*, the modern-spelling edition under the editorship of Staney Wells and Gary Taylor.

8. The ongoing information on computer work with Shakespeare in *The Shakespeare Newsletter* includes an article "On Computer Projects for Shakespeare Scholars" Fall 1984, 27, part of an ongoing project in that newsletter; see also "Shakespeare and the Computer: A Checklist of Scholarship" in May 1981. The inclusion of such projects in classroom instruction, by means of such pedagogically applicable programs TACT, is promising.
9. As this paper went to press, the Modern Language Association's *Profession '91* arrived. In it, Alan T. McKenzie, Professor of English and Director of Graduate Studies in the Department of English at Purdue University, explores the area of electronic academic networking and publishing in an article entitled "The Academic Online." Professor McKenzie urges humanists "to venture online, where texts, serious texts, may be sent farther and received faster, and with less effort and expense, than even Dr. Faustus might have imagined."

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